

Claim Or Claims

- 1) A method for reducing NO_X in a gas stream comprising the steps of sequentially exposing said gas stream to a first catalyst and a second catalyst wherein said first catalyst:
 - 5 a. converts at least a portion of said gas stream to a reducing gas,
 - b. reduces at least a portion of said NO_X in a first temperature range, and
 - c. absorbs at least a portion of said NO_X in said first temperature range, and wherein said second catalyst
 - d. reduces at least a portion of said NO_X in a second temperature range utilizing said reducing gas.
- 10 2) The method of claim 1 wherein said reducing gas is selected as a partially oxidized hydrocarbon.
- 3) The method of claim 1 wherein said reducing gas is selected as an aldehyde.
- 15 4) The method of claim 3 wherein said aldehyde is selected from the group consisting of acetaldehyde and formaldehyde.
- 5) The method of claim 1 wherein said gas stream is exposed to a plasma prior to the step of exposing said gas stream to said first catalyst.
- 6) The method of claim 1 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said first catalyst.
- 20 7) The method of claim 1 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said second catalyst.
- 8) The method of claim 1 wherein said gas stream is exposed to a plasma simultaneous with the steps of exposing said gas stream to said first catalyst and said second catalyst.
- 25 9) The method of claim 1 wherein said first catalyst is selected as a zeolite.

10) The method of claim 9 wherein said first catalyst is selected as a zeolite impregnated with an cation.

11) The method of claim 10 wherein said cation is selected from the group consisting of an alkaline cation, an alkaline earth cation, and combinations thereof.

5

12) The method of claim 1 wherein said first catalyst exhibits pores sizes of greater than 4 angstroms.

13) The method of claim 1 wherein said first catalyst exhibits pores sizes of greater than 7 angstroms.

10 14) The method of claim 1 wherein said first catalyst is selected as barium/zeolite Y (BaZY).

15) The method of claim 1 wherein said first catalyst is selected as barium/zeolite Y (BaZY) prepared via solution ion exchange of Ba²⁺ on sodium/zeolite Y (NaZY).

15 16) The method of claim 1 wherein said second catalyst is selected as a γ -alumina catalyst.

17) The method of claim 16 wherein said γ -alumina catalyst is impregnated with ions selected from the group consisting of transition metals.

18) The method of claim 17 wherein said transition metal is selected from the group consisting of Ag, In and Sn.

20

19) The method of claim 1 wherein said second catalyst is selected as Ag/ γ -alumina catalyst doped with between 8 and 0.1 wt% Ag on γ -Al₂O₃.

20) The method of claim 1 wherein said second catalyst is selected as Ag/ γ -alumina catalyst doped with between 3 and 0.5 wt% Ag on γ -Al₂O₃.

21) A method for reducing NO_X in a gas stream comprising the steps of sequentially exposing said gas stream to a first catalyst and a second catalyst wherein said first catalyst:

- a. converts at least a portion of said gas stream to a reducing gas,
- 5 b. reduces at least a portion of said NO_X in a first temperature range of up to about 500 degrees K, and
- c. absorbs at least a portion of said NO_X in said first temperature range, and wherein said second catalyst
- d. reduces at least a portion of said NO_X in a second temperature range of between about 450 degrees K to about 800 degrees K utilizing said reducing gas.

10 22) The method of claim 21 wherein said reducing gas is selected as a partially oxidized hydrocarbon.

23) The method of claim 21 wherein said reducing gas is selected as an aldehyde.

15 24) The method of claim 23 wherein said aldehyde is selected from the group consisting of acetaldehyde and formaldehyde.

25) The method of claim 21 wherein said gas stream is exposed to a plasma prior to the step of exposing said gas stream to said first catalyst.

20 26) The method of claim 21 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said first catalyst.

27) The method of claim 21 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said second catalyst.

25 28) The method of claim 21 wherein said gas stream is exposed to a plasma simultaneous with the steps of exposing said gas stream to said first catalyst and said second catalyst.

29) The method of claim 21 wherein said first catalyst is selected as a zeolite.

30) The method of claim 29 wherein said first catalyst is selected as a zeolite impregnated with an cation.

31) The method of claim 30 wherein said cation is selected from the group consisting of an alkaline cation, an alkaline earth cation, and combinations thereof.

32) The method of claim 21 wherein said first catalyst exhibits pores sizes of greater than 4 angstroms.

33) The method of claim 21 wherein said first catalyst exhibits pores sizes of greater than 7 angstroms.

34) The method of claim 21 wherein said first catalyst is selected as barium/zeolite Y (BaZY).

35) The method of claim 21 wherein said first catalyst is selected as barium/zeolite Y (BaZY) prepared via solution ion exchange of Ba²⁺ on sodium/zeolite Y (NaZY).

36) The method of claim 21 wherein said second catalyst is selected as a γ -alumina catalyst.

37) The method of claim 36 wherein said γ -alumina catalyst is impregnated with ions selected from the group consisting of transition metals.

38) The method of claim 37 wherein said transition metal is selected from the group consisting of Ag, In and Sn.

39) The method of claim 21 wherein said second catalyst is selected as Ag/ γ -alumina catalyst doped with between 8 and 0.1 wt% Ag on γ -Al₂O₃.

40) The method of claim 21 wherein said second catalyst is selected as Ag/ γ -alumina catalyst doped with between 3 and 0.5 wt% Ag on γ -Al₂O₃.

41) A method for reducing NO_X in a gas stream comprising the steps of sequentially exposing said gas stream to a first catalyst consisting of barium/zeolite Y (BaZY) having pores sizes of greater than 7 angstroms and a second catalyst consisting of Ag/γ-alumina catalyst doped with between 3 and 5 wt% Ag on γ-Al₂O₃ wherein said first catalyst:

- a. converts at least a portion of said gas stream to a reducing gas,
- b. reduces at least a portion of said NO_X in a first temperature range, and
- c. absorbs at least a portion of said NO_X in said first temperature range, and wherein said second catalyst

10 d. reduces at least a portion of said NO_X in a second temperature range utilizing said reducing gas.

42) The method of claim 41 wherein said reducing gas is selected as a partially oxidized hydrocarbon.

43) The method of claim 41 wherein said reducing gas is selected as an aldehyde.

15 44) The method of claim 43 wherein said aldehyde is selected from the group consisting of acetaldehyde and formaldehyde.

45) The method of claim 41 wherein said gas stream is exposed to a plasma prior to the step of exposing said gas stream to said first catalyst.

46) The method of claim 41 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said first catalyst.

20 47) The method of claim 41 wherein said gas stream is exposed to a plasma simultaneous with the step of exposing said gas stream to said second catalyst.

48) The method of claim 41 wherein said gas stream is exposed to a plasma simultaneous with the steps of exposing said gas stream to said first catalyst and said second catalyst.

25

49) The method of claim 41 wherein said first catalyst is selected as barium/zeolite Y (BaZY) prepared via solution ion exchange of Ba²⁺ on sodium/zeolite Y (NaZY).